# The pollutant treatment of water supply in Henan Oilfield

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| その他（別言語等）のタイトル | Henan 油田における供給水の汚染処理 |
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| journal or publication title | Memoirs of the Muroran Institute of Technology |
| volume | 59 |
| page range | 129-132 |
| year | 2010-03-19 |
| URL | http://hdl.handle.net/10258/464 |

Mem. Muroran Inst. Tech., 59（2009）129～132



# The pollutant treatment of water supply in Henan Oilfield

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(Received 27 May 2009, Accepted 20 November 2009 )

**Abstract**

The polluting situation of water supply in Henan oil field has been investigated. The pollutant sources have been analyzed. The treatment measures of water supply pollution include developing new water supply, saving on water, controlling groundwater level descending, enhancing management and formulating strict rules and regulations.

Key words**:** pollutant sources, treatment measure, Henan oil field

## 1　INTRODUCTION

With the developing of industry and agriculture, water has been polluted, and the situation has been getting worse [1-2], especially in the oilfield.

Henan oil field is a pearl in central of China. Since the oilfield is explored and developed in 1970s, drilling, mining, transporting and refining industries are developing quickly, and various organizations and hospitals and stores are set up, the population increased. Also water yield is increased every year concequently, polluted water are supplied as industrial and topwater, so that the pollution of water supply became serious. Therefore it is significant to research pollutant sources, and set up the measures of prevention and treatment.

## 2　OUTLINE OF WATER SUPPLY

There are 188 water wells in Henan oil field, which distribute in Weigang water supply, Shuanghe water supply, Guotan water supply, and Xiaermen water supply and so on, as shown in Fig. 1. Weigang water supply locates in the zone between Tanghe river and Baihe river, where the Quaternary System is developed widely with the thickness of 250 m. The shallow groundwater is pore-crevice phreatic water with clay ($Q_2$). The water yield is very small and the flow direction is consistent with the landform. The deep groundwater is pore confined water with gravel ($Q_1$), the aquifer thickness is 30-40 m, the buried depth 30-48 m, the groundwater recharge is crossrange runoff and shallow groundwater leakage. The regional cone of depression is formed. At present, there are 31 water wells in the water supply, the well depth is about 150 m, the extracting section is 40-120 m, and water yield is 40,000 $m^3$/d.

Shuanghe water supply locates in the pre-mountain of Tongbai mountain. Neogene System develops well, and thickness is about 230 m. Shallow

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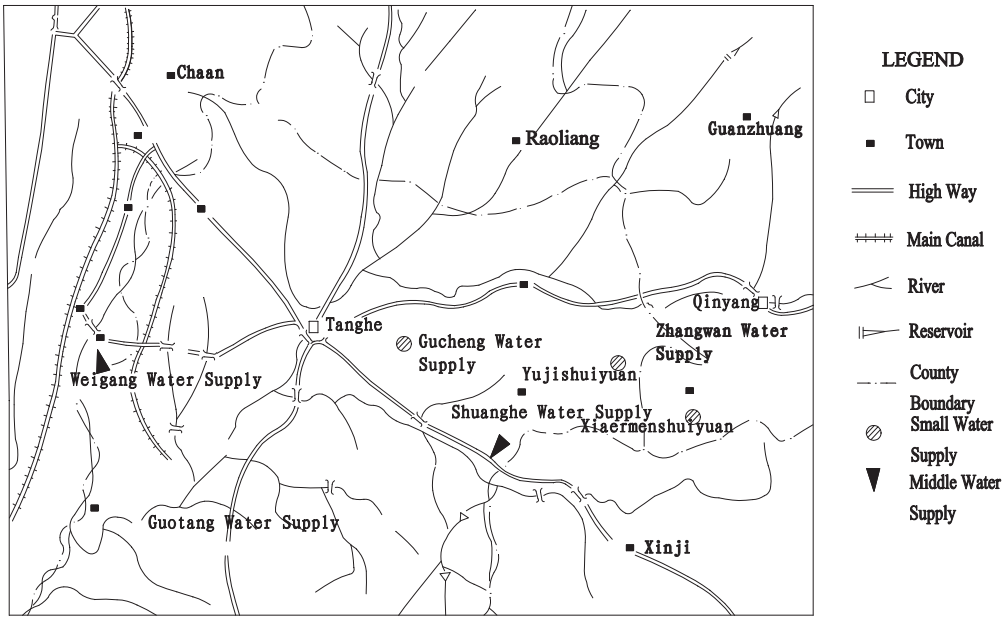


Figure 1 Distribution of water supply in Henan oil field

groundwater is pore phreatic water with gravel (Q , $Q_4$) in terrace or riverbank and pore phreatic water with muddy gravel ($Q_2$) in hill area. Deep groundwater pore artisian with muddy gravel($Q_1$, N), aquifer thickness 30-50 m, the groundwater recharge is mainly crossrange runoff and shallow groundwater leakage. At present there are 27 water wells in the water supply, the well depth is about 300 m, the extracting section is 20-290 m, and water yield is 38,000 $m^3$/d.

Other water supplies are smaller, water yield is less than 10,000 $m^3$/d. Their environmental geologic and hydrogeologic conditions are the same as Shuanghe water supply.

## 3 POLLUTING SITUATION

The groundwater quality is inspected, and groundwater level is observed in all water supplies in Henan oil field since 1984. A large amount of information has been gotten and the polluting situation of water supply has been recognized clearly.

Most shallow groundwater has been polluted heavily or middlely in Weigang water supply, and some have been polluted lightly in local section. The heavily polluted zones distribute in main industrial area of the oil field, for example, Jungaozhuang, Wuyicun and Xiaohuzhuang and so on. The groundwater is polluted by industrial pollution and domestic sewage. The main pollutants are oil, chloride, nitrate, ammonium nitrate, and so on. The moderately polluted zone is around the heavily polluted zone, and the main pollutants are nitrate, chloride, phenol, and oil, and so on. The lightly polluted zone distributes in north of the oil field, and no industry is mainly polluted by agricultural pollution. The main pollutants are nitrate. The deep groundwater in Weigang water supply is polluted softly and most area are lightly polluted The main pollutants are nitrate and fluoride. The moderately polluted zones distribute in hospital, mechanic repairing plant, and water and electric plant. The main pollutants are lead, oil and phenol.

The shallow groundwater has been moderately polluted in Shuanghe water supply. The main pollutants are chloride, nitrate, phenol, oil, and so on. The pollution of deep groundwater is higher than Weigang water supply. The main pollutants are nitrate, oil and organic matter and so on.

## 4 POLLUTANT SOURCES

### 4.1 Industrial pollutant sources

Henan oil field is a developing oil industrial base. The industrial types are simple. The main industry is oil mining, and secondary industries are oil refining and

mechanic repairing. The pollutant sources are mainly industrial waste water, others are well tube fracture, oil leakage of pipeline and so on.

The most harmful industrial waste water is de-oil sewage in combined station, secondary are waste water in refinery factory and well washing water and so on. The discharge capacity of industrial waste water is 2,049 $m^3$/d in Weigang district, 2,710 $m^3$/d in Shuanghe district. The main pollutants are sulphate, phenol, cyanide, chromium and oil and so on. The industrial waste water have not treated except for oil.

### 4.2 Living pollutant sources

The living pollutant sources are mainly rubbish and domestic sewage from organization, company, school and residential area. The rubbish is collected by farmers to be the fertilizer. A part of domestic sewage is discharged partly to rivers and to ponds. Most of field near the residential area are irrigated by domestic sewage. Therefore, domestic sewage pollutes the water sources heavily. The discharge capacity of domestic sewage is 19,402 $m^3$/d in Weigang district, 4,921 $m^3$/d in Shuanghe district. The harmful components in domestic sewage are phenol, ammonia water, arsenic, cubic, lead, zinc and so on.

The urinal, pond, pesticide and chemical fertilize are all the major sources of groundwater pollution in countryside.

## 5 TREATMENT MEASURE

Based on the analysis of water supply pollution in Henan oilfield, the following treatment measurement has been performed..

### 5.1 Developing new water supply and saving on water, let groundwater level stop descending

(1) Strengthen the exploration and development of new water supply, provide reserve water supply for the oilfield developing.

(2) Save on water and control groundwater yield. At present it is very heavy to waste water in production and daily life. For example, the washing water is 1000 $m^3$/d in refinery factory, about 2-4 times of standard. Water demand for living is generally 0.5 $m^3$/d, highest 0.91 $m^3$/d, far over the country's standard. With oilfield developing, groundwater level would draw down continuously and water quality would deteriorate every day if we did not save on water.

### 5.2 Enhance management and formulate strict rules and regulations

(1) Work out water demand quota for every unit and every staff, let everyone have a consciousness to save water.

(2) Deep groundwater stop mix-extracting with shallow groundwater, and water wells must be sealed. The abandoned water wells must be sealed with clay.

(3) Prevent well tube fracture and oil leakage of pipeline in oilfield development. The abandoned oil wells must be sealed with clay.

(4) Stop building ponds in river terrace, stop irrigating field using sewage water.

(5) Control discharge capacity and quality of sewage. Stop discharging sewage water that do not reach discharge standard.

### 5.3 Build up pollutant prevention area, control pollutant dispersion.

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Henan 油田における供給水の汚染処理

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概要

Henan 油田の供給水の汚染状況が調査されている。汚染源が解析された。供給水の汚染処理対策には新しい水供給減の開発、水の節約、地下水面の減少制御、厳密な規則や法律を定め、管理を強化することを含んでいる。

Key words: pollutant sources, treatment measure, Henan Oilfield

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